

08/788898  
✓

ROBOT HAVING MULTIPLE DEGREES OF FREEDOM

Abstract of the Invention

5           An improvement is set forth in a robotic arm  
structure which includes at least two links.  $\theta$  motion  
is provided about a primary axis at the proximal end  
portion of the proximalmost of the links. R motion  
proceeds radially from the primary axis whereby the  
10   distal end portion of the distalmost of the links can  
be moved in a radially extending straight line. An end  
effector is pivotally mounted for rotation relative to  
the distal end portion of the distalmost link about an  
end effector axis which is parallel to the primary  
15   axis. The structure is improved by adding one or more  
of a yaw motor, a roll motor and a pitch motor for  
rotating the wrist of the arm about the respective  
axes. A sensor array senses the R,  $\theta$ , Z and yaw, roll  
and/or pitch motions and creates and transmits  
20   electronic signals representative thereof to a computer  
controller which monitors and controls the R,  $\theta$ , Z and  
yaw, roll and/or pitch motions. Non-radial straight  
line motion and indeed, in certain embodiments any  
desired three-dimensional motion, is thereby enabled as  
25   is picking up of workpieces such as semiconductor  
wafers, flat panel displays and data storage disks,  
which are misaligned in cassettes or at workstations  
and/or are in cassettes which are misaligned and/or  
aligned and set up at an angle relative to the usual  
30   plane of operation of the arm.